



Researchers' Practice and Perception of Research Ethics and the Role of Institutional Support: Insights From a pan-European Researcher Survey

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Abstract

Research Ethics is a key element of Responsible Research and Innovation (RRI). In spite of an increased interest in this topic there is little empirical evidence about scientists' practice and perception of Research Ethics. Drawing on a large-scale survey among 4,180 European researchers we present unique insights into Research Ethics activities, researchers' motivation for ethical behavior, the perceived barriers and benefits as well as the role of institutional support. According to the survey results, most researchers consider ethical issues in their research projects and see it as part of good research practice or are convinced that research must be ethical. Perceived benefits of Research Ethics are higher quality of scientific outputs, higher social relevance of research, increased societal impact and a changed approach to risk. Barriers to ethics activities are particularly seen in the absence of institutional support and incentives. With regard to institutional support, we show that offers and infrastructures of Research Performing Organisations for Research Ethics are not well known among the employed researchers in general. Through a regression analysis about the influence of institutional support on Research Ethics we see at the same time that the provision of an Ethics team that researchers can address and the existence of a policy for designing ethical values and principles into research practice have a positive influence on researchers to engage in Research Ethics activities. The results underlines the importance of low-threshold services and personal contacts for researchers with ethical questions.

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Keywords Research ethics · Research integrity · Institutional support · Responsible Research and Innovation (RRI)

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Introduction

Academic research takes place in a highly competitive environment characterized by limited access to research funding, increasing demands and a market economy, that prioritizes productivity and speed over quality and methodological rigour. These conditions can create an atmosphere, where breaches of Research Ethics, such as research misconduct or malpractice can occur, which undermine the credibility of research and lead to negative consequences for researchers and society as a whole (Drolet et al., 2023; Sieber, 2004). This calls for a better management of the relationship between science and society, with a focus on the Ethics of academic research. The concept of Responsible Research and Innovation (RRI) can be understood as an approach that aims to change the consolidated model of research conduct in “the ivory tower” towards a model of science that is deeper embedded in society and sensitive to societal needs, expectations and concerns (Declich et al., 2022). The relevance to Research Ethics is that RRI addresses some of the core critiques of the academic system that have been widely discussed in higher education and science research in the past 30 years. Regardless of the many conceptualisations and definitions of RRI (Burget et al., 2017), most scholars of RRI are likely to agree that the essence of RRI is to better align research and innovation with societal needs and values. As such, the idea of science and society interacting with a view to social desirability, sustainability and the ethical acceptability of research and innovation can be found in most definitions of RRI. In this sense, the design of research and innovation should focus more emphatically on social, economic and ecological challenges. This is to be achieved by taking better account of diverse sources of knowledge and by using suitable procedures that promote the early and effective involvement of stakeholders, users and citizens in particular. In this way, research and innovation-related decisions are to be made more reflexive and placed on a broader, more plural and therefore more legitimate basis. Ultimately, RRI aims at a paradigm shift in the governance of research and innovation, in which the focus is no longer primarily on questions of technology- and innovation-induced risks and their reactive-regulatory containment, but rather on the democratic and inclusive understanding of which future should be promoted through research and innovation (Lindner & Kuhlmann, 2018). It is particularly this emphasis on directing research and innovation towards societal needs and challenges that distinguishes this approach from previous, mostly evaluative ones (Owen et al., 2021).

In view of the diverse epistemic sources and conceptual approaches RRI draws on, it is hardly surprising that conceptualisations of RRI are diverse and heterogeneous. The plurality of understandings and approaches can also be explained by the parallel development of the concept both in academia and in policy circles (Woolley et al., 2024). The probably most cited definition of RRI and major reference point has been introduced by von Schomberg (2014), who defines RRI as.

A transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society) (Schomberg, 2014).

The European Commission (2012) developed its own conceptualisation of RRI, describing it as diverse sets of societal actors working together during the whole research and innovation process in order to better align both the process and its outcomes with the values,

needs and expectations of society (European Commission, 2012). This abstract definition of RRI was operationalised by the introduction of the six dimensions or 'keys' (1) Research Ethics and Research Integrity, (2) Public Engagement, (3) Gender Equality, (4) Governance, (5) Open Science and (6) Science Literacy and Education.

RRI gained much of its importance due to a number of policy initiatives and particularly funding via several generations of European Framework Programmes. This support culminated in the 8th Framework Programme Horizon 2020 and its Science with and for Society (SwafS) work programme (2014–2020). With a budget of 462 million Euros, SwafS received more than 2,000 proposals in various calls and funded about 200 projects. In the following and current Framework Programme (FP9), Horizon Europe, RRI was then included as a cross-cutting topic and serves as an operational objective, although its visibility and its strategic placement has been reduced compared to Horizon 2020 (Declich et al., 2022; Delaney et al., 2020). The engagement with Research Ethics can be categorised in various ways. One distinction can be drawn by the formalisation of Research Ethics. Formal engagement refers to institutions dealing with the compliance of Research Ethics, ethics advisory committees or agenda setting in science, technology and innovation, whereas informal engagement in Research Ethics relates to ad-hoc activities, for example in research projects. Brom et al. (2015) further categorise Research Ethics in three areas - (I) Ethical governance, which focusses on the institutionalisation of compliance and addresses academic integrity and the protection of human subjects or animals in research, (II) Ethical deliberation, institutionalised as advisory systems such as ethics advisory bodies or ethics in agenda setting in science, technology and innovation, and (III) Ethical reflection, i.e. academic and societal discussion of ethical issues (Brom et al., 2015). Another categorisation is the level of ethical engagement. Here we can differentiate (I) ethical engagement at the individual level, i.e. attitudes and activities of individual researchers, (II) the level of individual organisations, such as universities and research performing organisations (RPOs).

This explorative study will focus on the engagement with Research Ethics at the individual and organisational level. In a first step, we analyse the perceptions and activities of researchers in Europe with regard to Research Ethics. We look at the individual activities of the researchers and their motivation, the perceived benefits as well as barriers. In a second step, we analyse the relationship between institutional support for Research Ethics and individual Research Ethics activities.

The perception of researchers of Research Ethics has already been the subject of various studies. These are predominantly descriptive empirical studies of ethical issues or ethical dilemmas reported by researchers (Colnerud, 2015; Davison, 2004; Jarvis, 2017; Swazey et al., 1993). Drolet et al. (2023) provide a comprehensive literature review of such empirical studies. However, most of these empirical studies have comparatively small sample sizes if they are based on interviews, for example (Birchley et al., 2017; Davies, 2019; Drolet et al., 2023). Others focus on the perspectives of scholars in individual disciplines only (Birchley et al., 2017; Davison, 2004; Fraser, 1997; McGinn, 2013; Sigmon, 1995) or have a strong regional focus on individual countries (Colnerud, 2015; Davies, 2019; Giorgini et al., 2015; Hunt et al., 1984; Lynøe et al., 1999). Thus far, empirically grounded insights based on quantitative survey data on researchers' behavior and perceptions with regard to Research Ethics are rather limited. With this study, we aim to make a contribution to closing this gap. Based on a large-scale survey of 4,180 scientists across Europe from a wide range of disciplines this article provides robust empirical findings regarding researchers' practice

of Research Ethics and the role of institutional support. Due to its explorative and broad approach, the study offers multi-faceted insights into individual researchers' motives for, perceived barriers to and benefits of Research Ethics practice.

The RRI Perspective in the Research Ethics Discourse

Research Integrity and Research Ethics symbolise the ideal way of research conduct. This is contrasted by research misconduct, which includes plagiarism as well as the falsification and fabrication of research results. Within this spectrum of research conduct are Questionable Research Practices (QRP), which are not considered as research misconduct, but nevertheless represent problematic research practices, as they fail to align with traditional values and accepted research practices (Ana et al., 2013; Komić et al., 2015; Steneck, 2006). However, in spite of an increased interest in Research Ethics, the discussion often lacks conceptual clarity. Already in 2002, Pimple commented on the field of Research Ethics as incoherent insofar as it cannot be considered “a field at all” (Pimple, 2002). Researchers often refer to terms such as Research Ethics, Research Integrity, Research Misconduct etc., interchangeably, reflecting the lack of definitional clarity of the terminology. As Helgesson and Bülow (2023) emphasize, Research Ethics is sometimes understood as a part of Research Integrity, with the latter presented as a widely encompassing term (Shaw, 2019), while others picture Research Integrity and Research Ethics as complementing fields, whereby the specific definitional attributions sometimes diverge significantly (Steneck, 2006). In fact, Research Integrity – as well as Research Ethics – is applied to various levels, i.e. researchers or research groups, research itself or RPOs, causing conceptual confusion about what is meant by it what not (Helgesson & Bülow, 2023). Some relate Research Integrity to the individual level only, calling it “researcher integrity” and understand it as researchers' commitment to professional values reflecting both attitudes and actions (Meriste et al., 2016). Others refer to integrity systems and structures for example through guidelines and regulation (Shaw, 2019) or stress soft governance of science through ELISE activities, audits or codes of conduct (Davies, 2019).

Besides, in particular the term Research Integrity is framed and used in various different ways for example with regard to the varying legislative definitions in different countries (Ana et al., 2013; Komić et al., 2015) but also depending on the scientific discipline (Colnerud, 2015; Davies, 2019; Davison, 2004; Fraser, 1997; Lynöe et al., 1999) or the societal context (Drolet et al., 2023; Horbach & Halfman, 2017). Horbach and Halfman (2017) for example identify differences in the language being used to describe integrity by scientists, policymakers or ‘the public’. Based on an analysis of scientific publications, policy documents and newspaper articles they find out that scientist tend to refer to integrity as a value that must be kindled (positive approach), while policy documents or newspapers rather focus on norm enforcement (negative approach). By co-occurrence analyses they show that the terms integrity and ethics have a strong connection, indicated that integrity is often discussed in a broader context including general ethics of science (Horbach & Halfman, 2017).

Due to its strong ethical implication, the concept of RRI serves as an anchor point for Research Integrity and Research Ethics (Magalhães, 2024). In fact, RRI does not differentiate between both concepts. The European Commission (2015) sees Ethics in RRI as a “field

in which internal norms and values relating to conduct, practice, culture and organisation operate together with the norms, values, practices and structures that society imposes on research through a variety of mechanisms". As a key dimension of RRI, Research Ethics and Research Integrity are divided into three subfields (European Commission, 2015):

1. Research Integrity and good research practice, which is concerned with issues such as scientific misconduct and QRP. This refers to the gap between codified rules and the actual norms and values of scientific communities as expressed in practice; new organizational measures to improve accountability with respect to research integrity; and neutrality and conflicts of interest and bias as an ethical as well as a quality problem.
2. Research ethics for the protection of the objects of research is a well-developed dimension with institutions and practices for such protection. The ultimate goal of policy in this field is that human beings, animals and other objects of research are duly protected; proper functioning of institutional procedures are clearly relevant measures for this goal.
3. Societal relevance and ethical acceptability of R&I outcomes. This dimension as an RRI key is the one that is closest to the general policy of RRI as a cross-cutting principle and the one for which the EU has its most distinct role to play (ethics reviews).

The concept of Research Ethics and Research Integrity as a key dimension of RRI reflects its normative and systemic approach to science governance. Given the potential implications of RRI for actual research practices, opening the "black box" at the individual level seems an important step in improving our understanding of the interplay between RRI as a governance approach to Research Ethics and individual researchers' behavior and perceptions in this regard. To this end, we present the results of a large-scale survey among 4.180 European researchers. The operational understanding in research and delineation of its institutionalization is fundamental to the design of the researcher survey and its questions on researchers' practice and perception of Research Ethics and the role of institutional support. The items on institutional support structures relate to policies for promoting Research Ethics through ethics committees or research integrity offices at scientific institutions in particular and were derived from the MoRRI indicators report on Monitoring the evolution and benefits of RRI (Peter & Maier, 2018).

Methods and Data

Development of a Selection Frame for Research Performing Organisations

According to the research protocol for this study developed by Mejlgaard et al. (2021) the sample for the researcher survey was based on a sample of 122 randomly selected RPOs in 29 European countries. For each of the countries in the study, a selection of RPOs was chosen for inclusion. To ensure a reasonable coverage across the countries, either 2, 4 or 6 RPOs were included depending on the size of the country. For the Republic of Cyprus, Luxembourg, and Malta, 2 RPOs are selected. For Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania,

Netherlands, Norway, Portugal, Romania, Slovakia, Slovenia, and Sweden, 4 RPOs were chosen and for Germany, France, Italy, Poland, Spain, and the UK, 6 RPOs.

In order to capture the diversity in basic organisational properties across the RPOs selected, a sampling frame has been built from the publicly available European Tertiary Education Register (ETER) database. The database covers Higher Education Institutions (HEIs) in Europe across three categories: (1) University; (2) University of applied science/college, which are organisations that can typically not offer doctoral programmes and are often heavily oriented towards (professional) education; and (3) Other, which cover e.g. military schools and art academies for example. As this study is focused on organisations performing research as a main component of their mission, only organisations in category 1 (universities) were included, with Malta as the only exception, since only one Maltese HEI was classified as university. It should further be observed that only two HEIs were classified as a 'university' in Luxembourg and four in Slovenia (equivalent to the number of organisations to be included in the study), thus sampling was not possible in these countries.

The established sampling frame for the countries included in the study is 1.038, including the HEIs from Luxembourg, Malta and Slovenia. The data in the ETER database stems from information that has been collected at different times. The years of collection thus differ among the HEIs, but for 923 out of 1.038 HEIs that year is 2016. Most often the information has been collected nationally at the same time, and difference in time should therefore not affect the sampling on a national level. Overall, of the 1.038 HEIs included for the sampling, the year of data collection is distributed as follows: 75 in 2017, 923 in 2016, 4 in 2015, 6 in 2014, 9 in 2013, 17 in 2012, and 4 in 2011. Information about Horizon 2020 funding was acquired through the publicly available Community Research and Development Information Service (CORDIS) of the European Commission. Funding data was obtained for 647 out of the 1.038 HEIs. The remaining institutions have either not received any funding through Horizon 2020 or could not be located in the CORDIS database even following extensive manual searches. CORDIS contains records of projects that have received funding rather than systematic coverage of organisations. Due to the number of HEIs with missing information about Horizon 2020 funding, this variable was not included in the sampling of RPOs in all countries.

Four variables were used for sampling, three of which are available in the ETER database of HEIs: (1) Size of the organisation, measured by total number of staff plus total number of students; (2) Research intensity, measured by the ratio of students to academic staff; (3) Research orientation, understood as the degree of plurality (as opposed to concentration) within the organisations' research activities, measured based on the relative allocation of students across different academic fields; and (4) the total amount of funding received from Horizon 2020. Specifically, plurality is measured by the standardised square root of the squared sum of differences between theoretical mean of each academic subject, assuming an equal distribution, and the empirical number of students in each academic field. This variable is thus standardised across all available universities in the ETER database from European countries included in the study. The other variables used for the sampling process are also standardised, however these are standardised within each of the countries. This makes sure that the difference between the universities of each country are proportional, ensuring a representative national sampling.

In some countries, not all variables can be populated with information, resulting in the sampling being conducted somewhat differently across countries. For some countries, e.g.,

size is instead measured as total number of students, as this was the only data available related to the size of the organisations.

Due to the limited number of organisations needed from each country, stratified sampling in the conventional sense is not possible for the selection of organisations in this study (Neyman, 1992). Therefore, the sampling is conducted by clustering all available organisations within each country, based on the variables available in the country. The clustering algorithm is then tasked with finding a number of clusters for each country, corresponding to the number of organisations needed from the country. One organisation from each cluster is consequently chosen at random. This gives a representative sample of RPOs from each country, based on the available variables, and thus assures an approximately representative sample of all RPOs in the EU (Mejlgaard et al., 2021). This procedure can be described as sample matching (Elliott & Valliant, 2017). This technique is used to enhance the accuracy and representativeness of data by selecting cases of a nonprobability sample to align closely with important population characteristics (Baker et al., 2013).

Survey Statistics

Among these 122 European RPOs, scientists of all scientific career levels were researched and contacted. The contact information was collected using ORCID queries. The personalized online survey was conducted between November 2023 and January 2023. In total, 127,395 researchers (gross sample) were identified and invited to participate in the survey. Among these, 105,224 researchers received the e-mail invitation. The remaining persons could not be contacted due to absences, invalid or outdated contact information. A total of 5,420 researchers participated in the survey, amounting to an overall participation rate of 5.2% (adjusted gross sample). Further data cleaning and validation processes were implemented in order to obtain reliable and high-quality survey data. The removal of 1,240 cases in the survey who did not sufficiently meet the required quality criteria, e.g. early survey break-ups, resulted in a cleaned net sample of 4,180 participants (net sample).

Of the net sample, 54.5% were men and 41% women. A further 0.9% stated non-binary, 0.4% a different gender not mentioned in the survey and another 3.6% of the respondents preferred not to state their gender.

With regard to their current academic career stage, a qualitative categorization of career levels was preferred to a description of scientific positions or titles, due to the career-specific differences in the respective higher education systems of the countries. All in all, 15.8% of respondents described themselves as “first stage researchers” (i.e. up to the point of PhD), 20.4% as “recognized researchers” (PhD holders or equivalent who are not yet fully independent), over a third of the respondents (34.8%) selected “established researcher” (researchers who have developed a level of independence); and a further 29.1% as “leading researchers” (researchers leading their research area of field). The selection was based on the subjective assessment of the survey participants.

With respect to respondents' work experience (defined by number of years at post-Master's level), more than one-third of respondents (38%) reported having more than 20 years of experience. Early career researchers with experience of up to five years comprised slightly less than one-fifth of respondents (17%). By scientific career stage, established researchers (R3) formed the largest group of respondents (35%), followed by leading researchers (R4, 29%), recognised researchers (R2, 20%), and first stage researchers (R1, 16%).

In addition, 22.8% of participants categorized themselves as Social Sciences and Economics, 20.8% as Natural Sciences (Physics, Chemistry, Geosciences, Astronomy and Biology), 17.1% chose Engineering and Technology, 16.3% Medical and Health Sciences. Furthermore, 9.5% stated Arts and Humanities, 5% Structural Science (i.e. Mathematics, Informatics, Logic), and 3.6% Agricultural and Veterinary Sciences. A further 5% were unable to categorize themselves according to the answers given and stated other disciplines in an open text box.

Among the 122 different RPOs, Scandinavian and Western European RPOs were most widely represented. The top five most represented RPOs are Uppsala University (4.9%), University of Oslo (4.5%), Sapienza University of Rome (4.3%), University of Helsinki (4.1%), Ghent University (4.2%), and Aarhus University (3.8%).

Outcome Variables

Researcher practices and perceptions regarding Research Ethics were surveyed in several question blocks. Various Research Ethics activities were derived from the used working definition of “Research Ethics”, i.e. the application of ethical principles or values to various issues and fields of research, including ethical aspects of the design and conduct of research, whether research results may be misused, and aspects of scientific misconduct. A total of seven Research Ethics activities were surveyed: (i) I consider ethical issues when designing my own research, (ii) I involve other researchers competent in ethics in my projects, e.g. in interdisciplinary research or as ethics advisory, (iii) I include work packages in my research that deal particularly with ethical issues that arise in my research, (iv) I submit my research projects to ethical review, (v) I act as reviewer in ethics reviews for projects, (vi) I contribute to the development of ethical standards in my discipline, (vii) I contribute to training on ethical issues in my discipline. The observation period for the Research Ethics activities was set at three years. The following response options were available for the seven statements: (1) No, in none of them, (2) Yes, in few of them, (3), Yes in most of the projects, and (4) Yes, in all projects I have been part of (in the last three years).

In addition to Research Ethics activities, also experiences with Questionable Research Practices (QRP) were surveyed. The following practices were surveyed in this regard: (i) Willfully failing to cite relevant publications that contradict your own beliefs, theories, hypotheses, (ii) When reviewing a manuscript, not investing the effort necessary to conduct a thorough review, (iii) Choosing not to report your findings if they could weaken or contradict your theories or hypotheses, (iv) Deliberately using another researcher’s unpublished idea without giving credit, (v) In a publication, failing to disclose relevant personal, financial, political or intellectual conflicts of interest, (vi) Including authors on a paper who had not contributed sufficiently to the work to merit authorship, (vii) Inadequately supervising or mentoring junior co-workers, (viii) Carrying out research without getting the required ethical approval. The following answer options were offered for these questions: (1) Never, (2) Rarely, (3) Sometimes, (4) Often, and (5) Does not apply in my case.

The survey participants were then asked about their motives for engaging in Research Ethics activities. The following motivations were surveyed: (i) I see it as part of good research practice, (ii) It is a requirement of the research funders, (iii) My institute rewards these activities, (iv) I want to comply with the respective legal requirements of my country, (v) I wish to maximize the reach and impact of my research, (vi) I am convinced that

research must be ethical, (vii) I have a personal interest in ethics. The response options used for these are as follows: (1) Strongly disagree, (2) Rather disagree, (3) Rather agree, (4) Strongly agree, and (5) Don't know. The motivation questions were only shown to those survey participants, who stated some engagement for at least one Research Ethics activity.

In a next step, participants were asked about observed or expected benefits that they associate with Research Ethics activities. The participants were able to give an answer to the following benefits: (i) Higher social relevance of scientific output, (ii) Higher quality of scientific outputs, (iii) Increased societal impact of my research, (iv) Changed approach to risk in my research. For each of the benefits, the participants could choose the following response options: (1) No, I have not observed, nor I do I expect such a benefit, (2) No, I have not observed such a benefit, but I expect it to arise, (3) Yes, I have already observed the benefit, and (4) Don't know.

Finally, participants were asked about perceived barriers to Research Ethics activities. A total of eight barriers were defined: (i) My University does not actively support ethics activities, (ii) No ethics committee at my university to support my projects and guide me to include ethics in my research, (iii) There are no particular institutional incentives to reward ethics in research, (iv) I did not find it relevant for my research, (v) It is too time consuming, (vi) The benefits are too few for me, (vii) I am not sure how to do it, (viii) Considering ethics negatively affects the quality of my research. The offered answer options correspond to those of the questions about the motivation for Research Ethics activities: (1) Strongly disagree, (2) Rather disagree, (3) Rather agree, (4) Strongly agree, and (5) Don't know.

Predicting Variables and Control Variables

In order to investigate the relationship between institutional support and individual research ethics activities, the participants were asked about existing support structures at their RPOs. Specifically, they were asked about the following institutional structures: (i) a practical ethics guide I can follow, (ii) Funding available for Ethics activities, (iii) An ethics team I can contact, (iv) Ethics training sessions I attend, (v) An institutional policy for integrating ethics in my research, (vi) A policy for designing ethical values and principles into projects and digital systems. Specific possible answers to these questions were: (1) Yes, (2) No, (3) Don't know, and (4) Not applicable.

In addition, various control variables were taken into account in the survey, which can have an influence on individual research practices and perceptions on Research Ethics. These include in particular the academic career stage ("first stage researchers", "recognized researchers", "established researchers", "leading researchers") and the scientific discipline (Social Sciences and Economics, Natural Sciences, Engineering and Technology, Medical and Health Science, Arts and Humanities, Structural Sciences, and Agricultural and Veterinary Sciences).

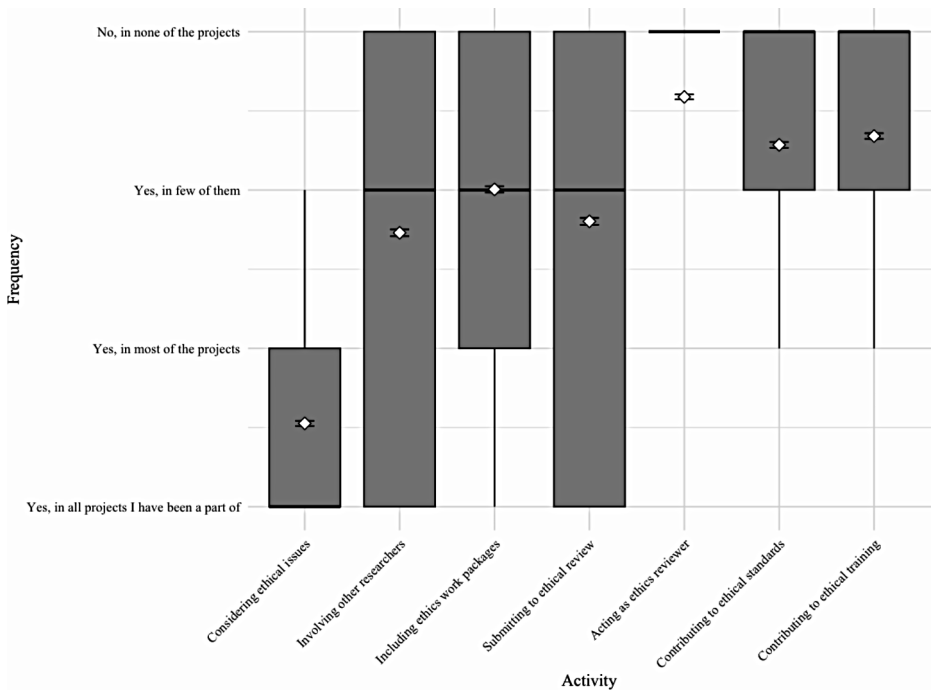


Fig. 1 Research Ethics Activities by European Researchers

Results

Researchers' Practice and Perception on Research Ethics

Research Ethics Activities

A large majority of 71% of the respondents report having considered ethical issues when designing their own research in all projects they have been part of over the past three years. With an arithmetic mean of 3.47¹ this is the strongest commitment of all Research Ethics activities (see Fig. 1). At the same time, this is a rather general and low-threshold activity with comparatively little effort. Up to 40% of respondents in total have involved other researchers competent in Ethics in their research projects or submitted their research projects to ethical reviews in either all or most of their projects. However, a similar proportion of participants (40% and 45%) stated that they had never done this before, resulting in rather low arithmetic means for these activities (2.27 and 2.2). The boxes in the box plots indicate the interquartile range, which comprises the middle 50% of the data. As the participants' responses to these two activities are widely dispersed, the boxes cover the entire range. A completely different picture emerges when it comes to the question of involvement as an ethics reviewer. A large majority of 80% of respondents stated that they have never acted as an Ethics reviewer. The median value, represented by the bold horizontal line, is therefore

¹ For statistical reasons, the answer options "don't know" or "does not apply to my case" were not considered in the presentation of the descriptive statistic analyses.

1 = “No, in none of the projects”, the arithmetic mean is 1.41. About the half of the respondents stated that they have included work packages in their research that deal particularly with ethical issues that arise in their research in at least few of their projects, resulting in an arithmetic mean and median value of 2. Furthermore, about two third of the participating researchers have neither contributed to training on ethical issues, nor to the development of ethical standards in their discipline in any of the projects. Consequently, only one box is displayed at the top of the illustration for these two activities. The arithmetic mean values are also correspondingly low (1.71 and 1.66).

Experiences with Questionable Research Practices

For the questions about QRP only very low approval ratings were obtained. For most of the QRP presented, a majority of respondents stated that they had never done this themselves, which is why the bold line representing the median is shown at 1 (“never”) for these activities (see Fig. 2). The arithmetic mean values for these activities are correspondingly low (1.28 for Willfully failing to cite contradicting matters, 1.24 for Choosing not to report weakening findings, 1.06 for Using another researcher’s unpublished idea without giving credit, 1.06 for Failing to disclose relevant conflicts of interest, 1.18 for Carrying out research without getting required ethical approval). However, the QRP that was mentioned most frequently by the researchers surveyed was “Including authors on a paper who had not contributed sufficiently to the work to merit authorship”. The majority of respondents (56%) stated that they had already done this before (arithmetic mean: 1.85). Almost 6% even stated that they did this frequently and a further 17% at least sometimes. Consequently, this is a QRP that is widespread in the scientific system. In a second place comes the QRP “Investing too little effort in reviews”. Here, 45% of the researchers stated that they do this rarely, sometimes or even often (arithmetic mean: 1.6). Another QRP that was mentioned by at least a quarter of respondents is “Inadequately supervising or mentoring junior co-workers”. Here the arithmetic mean is 1.34.

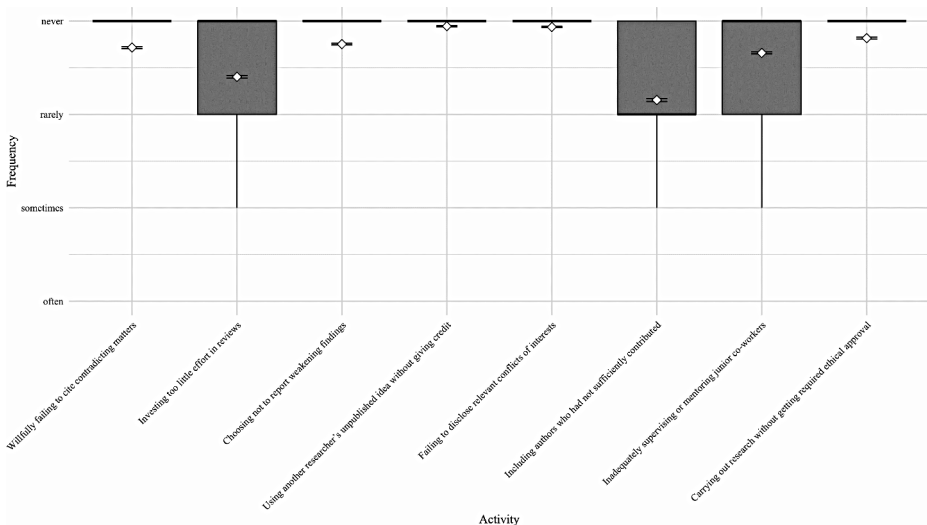


Fig. 2 Experiences of European Researchers with Questionable Research Practices

Motivations for Research Ethics

With regard to the motivations there is great consensus on the main driving forces to engage in Research Ethics (see Fig. 3). Large majorities of respondents (88%) strongly agree to engage in Ethics because they consider it as part of good research practice or because they are convinced that research must be ethical (also 88%). The arithmetic means for these motivations are correspondingly high (3,88 each). Beyond these, half of the respondents (51%) report they want to comply with the respective national legal requirements or research funders' requirements (47%). A significant proportion of respondents also show a high level of personal interest in Research Ethics (43% stated "strongly agree"). Slightly fewer researchers strongly agree with the statement that they want to maximize the reach and impact of their research through Research Ethics activities (35%). Across all options, respondents most disagree to being motivated by institutional rewards. Here only 16% of the respondents stated "strongly agree". It appears that institutional incentives for Research Ethics play a subordinate role in individual motivation. Besides the given statements, a free text field for other motives was offered. In the additional answers provided by respondents we observe variation in the importance and necessity or utility of Research Ethics across disciplinary fields or research subject from top priority (e.g. in animal experimentation) to not relevant (e.g. basic physics). Some respondents explained their disinterest in Research Ethics with the fact that it is not legally required in their respective scientific field and country context. Other driving motivations are, for example, reasons of personal responsibility or its contribution to originality, excellence, or a good academic culture.

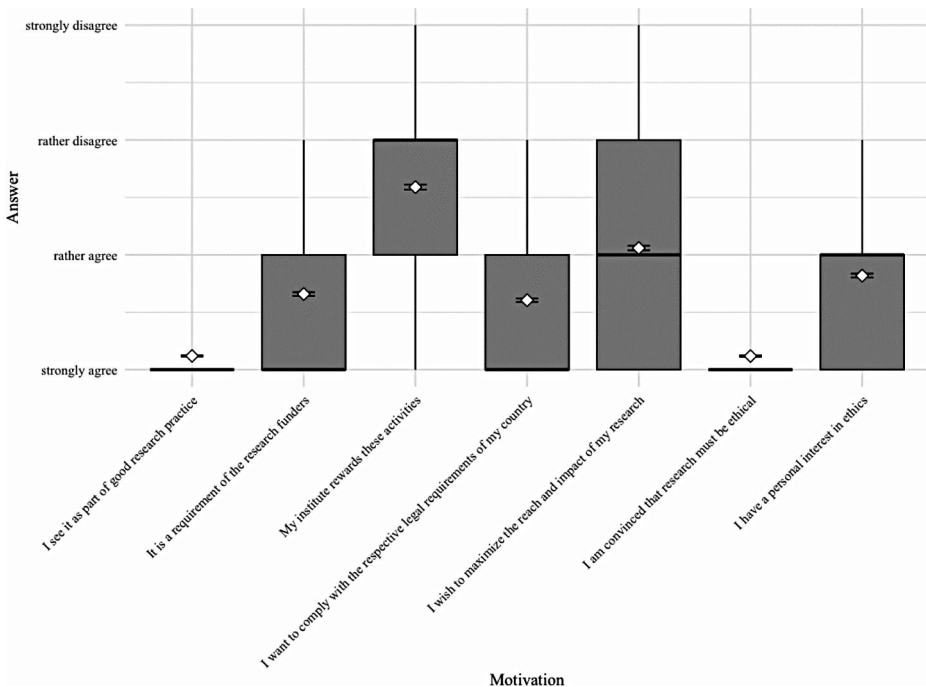


Fig. 3 Motivations by European Researchers for Research Ethics

Perceived Benefits of Research Ethics

When asked about perceived benefits of Research Ethics about one third of respondents (34%) have already observed a higher quality of scientific outputs as a result of ethical conduct (see Fig. 4). The arithmetic mean for this benefit is the highest at 2.13. On average, one fifth of respondents have already observed the other three benefits listed. However, the overall picture is divided, given that across all benefits, approximately one third still expects the benefit to arise, while a similar share of respondents express that they have not observed any benefits, nor expect any to occur. When examining the nature of the benefits, it can be also seen that benefits occurring on a smaller, individual scale are more frequently observed, while benefits with a wider scope that lie beyond the individual sphere (of influence and control), such as, for example, increasing societal relevance or impact, are observed less frequently. However, this may be rooted in the time-lag between the realization of small-scale gains and large-scale impacts, as expressed in the higher shares of respondents still expecting the societal benefits to occur. Additional benefits mentioned by respondents in an additional open question on benefits were better data replicability, the promotion of Research Integrity, a contribution to excellence, or “peace of mind”. Others suggested that Ethics should not be regarded as a means to an end, but as a non-negotiable code of conduct and key pillar of good science.

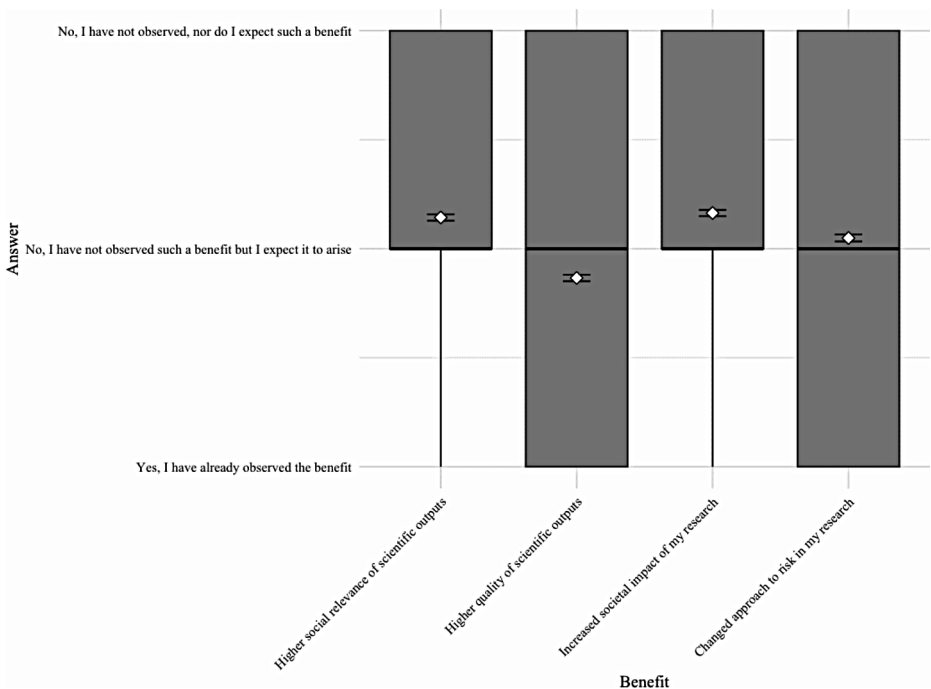


Fig. 4 Perceived benefits of Research Ethics by European Researchers

Perceived Barriers to Research Ethics

Most participants disagreed with the given statements when asked about the perceived barriers to Research Ethics (see Fig. 5). The arithmetic values are correspondingly low. There was only greater agreement with the statement “There are no particular institutional incentives” (36% of respondents strongly or rather agree). At first glance, this result is contradictory, as most of the participants stated in the questions about motivation a low significance of institutional reward for Research Ethics. This can be explained by the fact that the majority of respondents are obviously intrinsically motivated overall. Nevertheless, there are researchers who are also open to extrinsic motivation. At the same time, institutional incentives could certainly help researchers to become even more involved in Research Ethics. Conversely, a lack of institutional incentives certainly plays a role in the perception of barriers. Furthermore, we observe particularly great rejection of the statement that Ethics negatively affects the quality of research (arithmetic mean = 1.43). Among the numerous additional barriers mentioned by respondents, bureaucracy was the leader. Respondents consider changing regulations and complex, time-consuming approval procedures as a main hindrance to an ethical conduct of research and a factor preventing compliance. Respondents also express their frustration with the competitive dynamics in the research landscape in which ethical conduct creates a competitive disadvantage and is not rewarded accordingly.

The Role of Institutional Support for Research Ethics

Support Structures for Research Ethics at RPOs

As the response options for the questions on institutional support structures for Research Ethics are not (quasi-)ordinal scaled, the results are presented in a table and not in a box plot figure. Mean values are also not shown for this reason. A first key finding in this question is that a large proportion of scientists are simply not aware of the existence of support

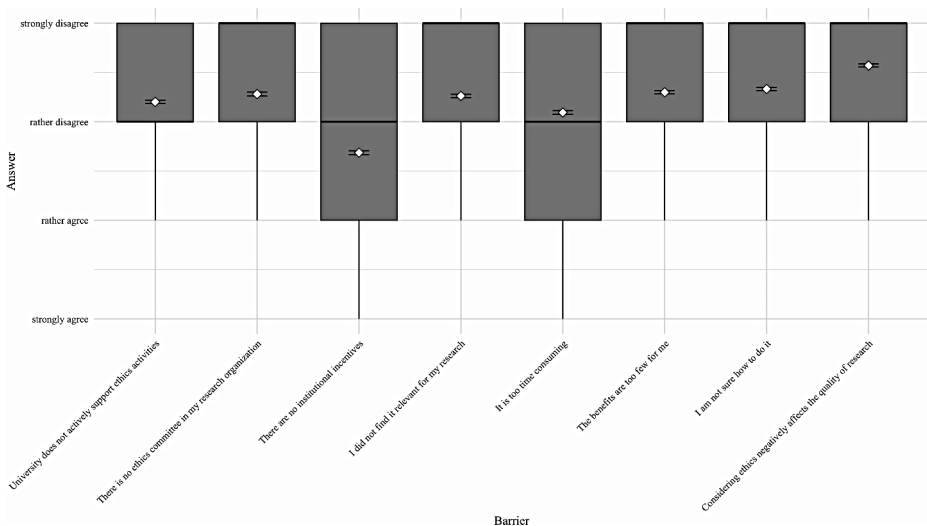


Fig. 5 Perceived Barriers to Research Ethics by European Researchers

structures at their RPO. In fact, a majority of respondents stated that they did not know whether funding for ethics activities was available at their RPO (53%) or whether a policy for designing ethical values and principles into projects and digital system exists (54%) (Table 1).

At least a slight majority of respondents stated that their RPO had an ethics team that could be contacted (52.3%). A slight majority confirmed the existence of a practical ethics guide to follow (47.7%) or an institutional policy for integrating ethics in my research (45.4%). Overall, institutional support for Research Ethics at RPO is not particularly well known to researchers.

Influence of Institutional Support for Research Ethics Practice

We further conducted a multiple linear regression analysis examining the correlation between institutional ethics support measures and the Research Ethics activities stated by the researchers in the survey. This analysis explores the impressions derived from the descriptive analysis.

The results of the regression analysis are shown in Table 2. The presentation of the both models m1 and m2 shows the significance of the control variables, as the response behaviour of the researchers is not influenced solely by institutional support structure. For example, the quality of the regression model (r^2) increases from 0.18 to 0.21 when the academic career stage and the scientific discipline are taken into account. It can be seen, for example, that younger scientists (PhDs are shown here as the reference category) show the lowest level of engagement with regard to Research Ethics activities. In contrast, leading researchers are more engaged in ethical activities, as they might have the resources and experiences for review activities, to define ethical standards or offer ethical trainings compared to the reference group of PhD students.

On the same time, researchers from the medical and health sciences (reference category) show the strongest commitment to Research Ethics activities, while all other disciplines show correspondingly lower values. This can be explained in particular by the high relevance of ethical aspects for scientific work in these disciplines, in particular due to the interaction with patients and the handling of sensitive (health) data.

Nevertheless, it must be stated that the regression analysis only shows the influence of the outcome variables on Research Ethics activities without missing values. Due to the small size of observations without missing values in the ethics activities and the institutional support, we cannot look into the influence of institutional support on the individual

Table 1 Institutional support for Research Ethics

Institutional support	Yes	No	Don't know	Not applicable
A practical ethics guide I can follow	1,585 (47.7%)	405 (12.2%)	1,280 (38.5%)	51 (1.5%)
Funding available for Ethics activities	252 (7.6%)	1,195 (36.2%)	1,774 (53.7%)	84 (2.5%)
An ethics team I can contact	1,735 (52.3%)	454 (13.7%)	1,076 (32.4%)	52 (1.6%)
Ethics training sessions I can attend	1,307 (39.6%)	604 (18.3%)	1,334 (40.4%)	55 (1.7%)
An institutional policy for integrating ethics in my research	1,500 (45.4%)	430 (13.0%)	1,311 (39.6%)	66 (2.0%)
A policy for designing ethical values and principles into projects and digital systems	910 (27.6%)	516 (15.6%)	1,780 (54.0%)	93 (2.8%)
<i>N</i>				4179

Table 2 Regression Analysis I

	m1 b/se	m2 b/se
Ethics guide	0.285 (0.22)	0.332 (0.22)
Ethics funding	0.015 (0.22)	0.252 (0.22)
Ethics team	0.765*** (0.20)	0.546** (0.20)
Ethics Training	0.057 (0.19)	0.186 (0.18)
Institutional Policy	0.070 (0.23)	-0.118 (0.23)
Design Policy	0.643** (0.24)	0.620** (0.23)
<i>Career stage</i>		
Postdoc		0.241 (0.31)
Established researcher		0.391 (0.27)
Leading researcher		0.888*** (0.26)
<i>Scientific Discipline</i>		
Agricultural and Veterinary Science		-0.337 (0.45)
Engineering and Technology		-0.718** (0.25)
Structural Sciences		-1.295** (0.42)
Natural Sciences		-1.589*** (0.26)
Social Sciences and Economics		-0.025 (0.19)
Arts and Humanities		-0.282 (0.27)
Constant	3.363*** (0.15)	3.403*** (0.31)
r ²	0.118	0.210
df _r	672.000	661.000
bic	2906.020	2880.699

* p<0.05, ** p<0.01, *** p<0.001

Reference categories are PhD and Medical and Health Sciences.

Research Ethics activities, especially when including the categorical control variables. This is due to the fact that the regression analysis could only take into account those cases of respondents that answered the question on Research Ethics activities and stated “Yes” or “No” to the questions on institutional support. However, many respondents were not aware of the institutional support structures, as shown by the frequent “Don’t know” responses. These cases were excluded from the analysis of the correlation between institutional support and Research Ethics activities, therefore the number of cases taken into account is lower (see $n_r=672$ and 661 respectively), resulting in limitations of the model.

As far as the role of institutional support is concerned, the regression analysis shows two statistically significant correlations in particular: The provision of an Ethics team that researchers can address has a positive influence on researchers’ engagement in Research Ethics activities. This underlines the importance of low-threshold services and personal contacts for researchers with ethical questions. In addition, the existence of a policy for designing ethical values and principles into projects and digital systems also leads to a greater commitment from researchers in Research Ethics activities. This shows that concrete and also detailed frameworks and regulations for the implementation of ethical values in research projects have a considerable influence. A lack of statistical correlations between the other institutional support structures mentioned and Research Ethics activities does not mean that this institutional support is not relevant. In fact, ethics guides, funding for ethics activities, ethics training or institutional policies for integrating ethics into research projects play an important role, either for certain groups of researchers or for certain ethical issues and Research Ethics questions. Nevertheless, the presence of an ethics team and a policy for designing ethical values and principles into projects lead to an even stronger engagement of researchers in Research Ethics activities according to the regression analysis.

If we differentiate between the different groups of scientists who, regarding the existence of institutional support structures, either answer ‘yes’, ‘no’, ‘don’t know’ or ‘not applicable’, the differences become more visible. In a further regression analysis, the group of scientists who answer ‘yes’ is shown as the reference category (see Table 3). The analysis shows that, compared to the reference group, the other three groups show negative values for all output variables, indicating a lower level of Research Ethics practice. In most cases, these differences are statistically significant. At the same time, the regression analysis also shows that there are hardly any differences between the researchers of other three categories. Their values are relatively similar. This means that researchers who confirm and actively perceive the existence of institutional support structures at their RPO are significantly more involved in Research Ethics practices than those who either answer ‘No’, ‘don’t know’ or ‘not applicable’.

Discussion

Given the increased importance of Research Ethics with regard to new forms of scientific knowledge production it is crucial to better understand the actual activities of researchers, motives, benefits and barriers reported by researchers in Europe. This article contributes to the rather conceptual debate about the role of Research Integrity as a central element of RRI and adds strong empirical base. Existing empirical studies on the perception of researchers of Research Ethics are often limited in scope as they are based on small sample sizes

Table 3 Regression Analysis II

	Activities			
	Full sample (1)	Full sample (2)	Sub sample (3)	Sub sample (4)
Ethics guide (No)	-0.055 (0.051)	-0.076 (0.048)	-0.155* (0.088)	-0.174** (0.084)
Ethics guide (Don't know)	-0.115*** (0.034)	-0.104*** (0.032)		
Ethics guide (Not applicable)	-0.111 (0.185)	-0.082 (0.174)		
Ethics funding (No)	-0.171*** (0.054)	-0.237*** (0.051)	-0.149* (0.083)	-0.253*** (0.083)
Ethics funding (Don't know)	-0.292*** (0.052)	-0.297*** (0.049)		
Ethics funding (Not applicable)	-0.113 (0.125)	-0.150 (0.117)		
Ethics team (No)	-0.276*** (0.047)	-0.170*** (0.044)	-0.361*** (0.080)	-0.263*** (0.078)
Ethics team (Don't know)	-0.268*** (0.035)	-0.163*** (0.033)		
Ethics team (Not applicable)	-0.238 (0.206)	-0.149 (0.194)		
Ethics training (No)	-0.003 (0.045)	-0.019 (0.043)	-0.038 (0.079)	-0.079 (0.076)
Ethics training (Don't know)	-0.094*** (0.033)	-0.088*** (0.031)		
Ethics training (Not applicable)	-0.280 (0.210)	-0.238 (0.197)		
Institutional Policy (No)	-0.074 (0.056)	-0.027 (0.052)	0.030 (0.092)	0.101 (0.088)
Institutional Policy (Don't know)	-0.164*** (0.037)	-0.108*** (0.035)		
Institutional Policy (Not applicable)	-0.064 (0.160)	-0.004 (0.150)		
Design Policy (No)	-0.266*** (0.056)	-0.246*** (0.053)	-0.251*** (0.094)	-0.228** (0.090)
Design Policy (Don't know)	-0.300*** (0.036)	-0.282*** (0.034)		
Design Policy (Not applicable)	-0.502*** (0.118)	-0.450*** (0.111)		
Recognised Researcher		0.050 (0.040)		0.073 (0.114)
Established Researcher		0.060* (0.037)		0.132 (0.102)
Leading Researcher		0.192*** (0.038)		0.309*** (0.100)
Agricultural and Veterinary Science		-0.444*** (0.065)		-0.191 (0.181)
Engineering and Technology		-0.505*** (0.041)		-0.401*** (0.099)
Structural Sciences		-0.686*** (0.060)		-0.615*** (0.168)
Natural Sciences		-0.649*** (0.039)		-0.694*** (0.096)
Social Sciences and Economics		-0.152*** (0.037)		-0.139* (0.081)
Arts and Humanities		-0.325*** (0.047)		-0.225** (0.107)
Constant	2.837*** (0.047)	3.032*** (0.057)	2.887*** (0.064)	3.004*** (0.107)
Observations	3,053	3,048	670	670
R ²	0.217	0.312	0.163	0.252
Adjusted R ²	0.213	0.306	0.156	0.235
Residual Std. Error	0.691 (df = 3034)	0.648 (df = 3020)	0.775 (df = 663)	0.737 (df = 654)
F Statistic	46.791*** (df = 18; 3034)	50.734*** (df = 27; 3020)	21.574*** (df = 6; 663)	14.709*** (df = 15; 654)

Note:

*p<0.1; **p<0.05; ***p<0.01

(Birchley et al., 2017; Davies, 2019; Drolet et al., 2023) or focus on individual countries or specific disciplines of researchers only (Birchley et al., 2017; Colnerud, 2015; Davison, 2004; Fraser, 1997; McGinn, 2013; Sigmon, 1995). Based on a survey of 4,180 researchers from 122 RPOs in 29 European countries this article provides new and empirically robust insights into researchers' practice and perception of Research Ethics. The results show that a vast majority of researchers consider ethical issues in the design of their research. A further engagement in ethics activities, however, is reported only by a smaller group of researchers. In fact, there are considerable differences in Research Ethics activities by discipline, with researchers from Medical and Health Sciences showing the highest Ethics engagement. In addition to Research Ethics, the study also examined the observations of QRP by researchers. Even though all in all comparatively few observations were reported here, two QRP were mentioned quite often by researchers: "Including authors on a paper who had not contributed sufficiently to the work to merit authorship" and "Investing too little effort in a review". 56% and respectively 45% of the surveyed researchers stated that they had already done this before. The results hint to widespread distribution of some QRP related to existing pressures and unfavourable power relations within the scientific system that pose threats to research integrity. With regard to motivation, there is a great consensus on the main drivers for engagement in Research Ethics activities. In general, the motivation is mainly normative and intrinsic. Most see it as part of good research practice or are convinced that research must be ethical. Some researchers also report extrinsic motivation, such as complying with legal requirements of the country or of research funders. Regarding perceived benefits of about one third of respondents already have observed higher quality of scientific outputs as a result of ethical conduct. On average, one fifth have already observed higher social relevance of scientific outputs, increased societal impact and a changed approach to risk in research. Most barriers to ethical conduct obviously don't play a major role for researchers to engage in research activities. Nevertheless, over a third of the researchers miss particular institutional incentives to reward ethics in research.

Another contribution of this article is the analysis of the connection between perceived institutional support structures at the RPOs and individual Research Ethics activities. A key finding from the survey was that many researchers are unaware of the support structures provided by their RPOs. For example, more than half of the respondents did not know whether their RPO has an ethics guide they can follow or a policy for designing ethical values and principles in their research. The study shows that researchers who confirm and actively perceive the existence of institutional support structures at their RPOs are significantly more involved in Research Ethics practices than those who are not aware of such support. A key implication for RPOs from this result is therefore to make their already existing institutional support structures more visible to the researchers. The regression analysis shows two statistically significant correlations between institutional support and Research Ethics engagement: The provision of an Ethics team that researchers can address has a positive influence on researchers to engage in Research Ethics activities. This underlines the importance of low-threshold services and personal contacts for researchers with ethical questions. In addition, the existence of a policy for designing ethical values and principles into projects and digital systems also leads to a greater commitment from researchers in Research Ethics activities. This shows that concrete and also detailed guidelines and regulations for the implementation of ethical values in research projects have a considerable

influence. The results can inform universities how to diversify and better align institutional support structures to researchers' needs.

For the interpretation of the survey results, certain limitations must be taken into account. Given a large-scale survey among scientists with a specific focus and response rate of 5,2%, it must be assumed that those scientists who tend to have a certain openness or positive attitude towards the topic participated in the survey. This could distort the analysis, for example, of the significance of and the perceived impacts of Research Ethics. Furthermore, cognitive biases can interfere with the perception and practice of Research Ethics. Despite the broad scope, it is difficult to draw conclusions about this issue in an international comparative perspective. Further studies should therefore focus more on possible cultural influences on the understanding and practice of Research Ethics. The same applies to the structural institutionalization of Research Ethics in different higher education systems.

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Author Contributions All authors contributed to the study conception and design presented in this paper. Data collection and analysis was mainly performed by Hendrik Berghaeuser, while Max Prass conducted the regression analysis. Ralf Lindner and Hendrik Berghäuser elaborated the current state of research on Research Ethics and Responsible Research. All commented on previous versions of the manuscript and read and approved the final version for submission.

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Data Availability The cleaned and anonymised survey dataset has been uploaded to the Zenodo open repository. The dataset can be found and accessed here: <https://zenodo.org/records/12579202> (<https://doi.org/10.5281/zenodo.12579202>). Further data and sources generated in the SuperMoRRI project can be found here: <https://zenodo.org/communities/supermorri/>.

Declarations

Ethical Approval N/A.

Author Consent All authors listed here declare their explicit consent to submit this paper. They have approved the manuscript and agree with the content of the article. Furthermore, all authors have obtained consent from the Fraunhofer Institute for Systems and Innovation Research ISI beforehand.

Informed Consent The results presented in this article are based on a survey of scientists in Europe. To participate in the survey, the scientists invited had to give their consent for their data to be used for research purposes in compliance with data protection regulations. Persons who did not give their consent did not take part in the survey. Furthermore, no participants withdrew their consent at a later date.

Competing Interests The authors have no relevant competing financial or non-financial interests to disclose.

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